

CLAIMS

1. A photodetection device comprising:

a semiconductor substrate having a back surface which serves as a light-incident surface, and a front surface which opposes said back surface and is provided with a charge reading part constituted by a charge-coupled device that detects light propagating from said back surface, said semiconductor substrate having a structure such that the thickness of a region at which said charge reading part is disposed is thinner than the thickness of the remaining region;

10 a cooling device cooling said charge reading part, said cooling device having a cooling surface which has a size that is larger than the region at which said charge reading part is disposed and yet smaller than the entirety of said front surface of said semiconductor substrate, and which contacts the front surface of said semiconductor substrate while covering the entirety of said charge reading part;

15 a package having a cavity which houses both said semiconductor substrate and said cooling device, and being provided with package terminals electrically communicating between said cavity and the exterior thereof;

20 electrode pads provided on said front surface of said semiconductor substrate and positioned at the peripheral of the region covered by said cooling surface; and

25 bonding wires electrically connecting said package terminals and said electrode pads.

2. A photodetection device according to claim 1, wherein said cooling device is fixed to said package while the surface at the opposite side of said cooling surface contacts a bottom part of said cavity of said package, and

5 wherein a working opening is provided at the cavity bottom part of said package that correspond to said electrode pads and said package terminals.

10 3. A photodetection device according to claim 2, further comprising a cover for closing said working opening provided at the cavity bottom part of said package.

4. A photodetection device according to claim 1, wherein said package has a top plate for closing an upper opening of said cavity.

15 5. A photodetection device according to claim 1, wherein said semiconductor substrate, housed in said cavity, is supported on said package via said cooling device while being separated by a predetermined distance from the inner wall of said cavity.

20 6. A photodetection device according to claim 1, wherein said cooling device includes a Peltier element, and a cooling plate contacting the cooling side of said Peltier element, and

 wherein a back surface of said cooling plate, which is opposite the surface that contacts the cooling side of said Peltier element, contacts the front surface of said semiconductor substrate as the cooling surface.

25 7. A photodetection device manufacturing method comprising the steps of:

preparing a semiconductor substrate having a back surface which serves as a light-incident surface, and a front surface which opposes said back surface and is provided with a charge reading part constituted by a charge-coupled device that detects light propagating from said back surface, said semiconductor substrate having a structure such that the thickness of a region at which said charge reading part is disposed is thinner than the thickness of the remaining region;

5 preparing a cooling device having a cooling surface with a size smaller than the entirety of said front surface of said semiconductor substrate and yet larger than the region at which said charge reading part is disposed;

10 preparing a package having a cavity which houses both said semiconductor substrate and said cooling device;

15 disposing said cooling device inside said cavity of said package such that a back surface of said cooling device, at the side opposite said cooling surface, faces a cavity bottom part of said package;

20 disposing said semiconductor substrate in said cavity of said package such that said cooling surface contacts said charge reading part in a covering manner and yet said semiconductor substrate is separated from the inner wall of said cavity of said package by a predetermined distance; and

25 connecting electrode pads, which are disposed on said front surface of said semiconductor substrate and positioned at the peripheral to the region covered by said cooling surface, to

package terminals provided on said package, by bonding wires.

5. 8. A photodetection device manufacturing method according to claim 7, wherein the connections made by said bonding wires are made in a state in which said semiconductor substrate is supported by a jig that has been inserted from an upper opening of said cavity of said package.

10. 9. A photodetection device manufacturing method according to claim 7, wherein, at a bottom part of said cavity of said package, a working opening is provided at a position corresponding to said electrode pads and said package terminals, and

wherein the connections made by said bonding wires are made through said working opening.

15. 10. A photodetection device manufacturing method according to claim 9, wherein, after making the connections by said bonding wires, said working opening is closed by a cover.

20. 11. A photodetection device manufacturing method according to claim 7, wherein, after making the connections by said bonding wires, an upper opening of said cavity of said package is closed by a top plate.